

Shri Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR
(Empowered Autonomous)

Department of Statistics
M.Sc. – I (Statistics) and M.Sc. – I (Applied Statistics)
Internal Examination, September 2025

Course Code – DSC17STA11 / DSC18STA11 ; Course Name – Distribution Theory
Day & Date – Monday, 22/09/2025
Time – 11:15 am to 12:15 pm Marks: 20

Instructions:

- i) Que.1 is compulsory
- ii) From Que. 2 Attempt any 3 questions.
- iii) Figures to right indicates full marks.

Q1) Multiple Choice Questions:

[5]

1. A mixed distribution is:

- A) A distribution obtained by combining two discrete distributions.
- B) A distribution with both discrete and continuous parts.
- C) A distribution that is neither discrete nor continuous.
- D) A distribution formed by mixture of normal distributions.

2. The distribution function (CDF) of a mixed distribution is always:

- A) Continuous everywhere.
- B) Discontinuous at one or more points.
- C) Linear
- D) Constant

3. If a random variable X has probability mass at $x=0$ and density $f(x)$ for $x>0$, then $P(X=0)$ is called:

- A) Jump size of CDF at 0
- B) Variance
- C) Expectation
- D) Median

4. Following is the c.d.f. of random variable X.

$$F(x) = \begin{cases} 0 & ; x < 0 \\ kx/4 & ; 0 \leq x \leq 1 \\ 1 & ; x > 1 \end{cases}$$

Then the value of 'k' is

- A) 2
- B) 3
- C) 4
- D) 1

5. A coin is tossed twice. Let X be defined as $X = (\text{No. of head obtained} / \text{No. of tail obtained})$. Then which of the following is correct?

- A) X is a random variable
- B) X is not a random variable
- C) $X(HH) = 2$
- D) None of the above

Q2) Attempt any 3 questions out of 4.

[15]

1. Define Continuous random variable. Let X be a continuous random variable with pdf $f(x) = 3x^2$; $0 \leq x \leq 1$. Find 'a' and 'b' such that (i) $P(X \leq a) = P(X > a)$ (ii) $P(X > b) = 0.05$.
2. Define Mixed random variable and Mixture of Distribution Function. And state the properties of cumulative distribution function (c.d.f).
3. Decompose $F(x)$ into distribution function of a discrete random variable and distribution function of a continuous random variable.

$$F(x) = \begin{cases} 0 & ; \text{if } x < 0 \\ 0.5 + x/2 & ; \text{if } 0 \leq x \leq 1 \\ 1 & ; \text{if } x \geq 1 \end{cases}$$

4. a) Explain the transformation of univariate random variable in case of discrete random variable.
- b) Let X the random variable have the distribution as follows,
 $P(X = 0) = P(X = 2) = p$; $P(X = 1) = 1 - 2p$; for $0 \leq p \leq \frac{1}{2}$
For what value of p is the $V(X)$ being maximum?

Vivekanand college, Kolhapur
(An Empowered Autonomous Institute)
Department of Statistics
M.Sc. I (Statistics / Applied Statistics)
Sem I Internal Examination 2025-26
Estimation Theory (DSC17STA12 / DSC18STA12)

Date :23/09/2025

Time:11.15 am to 12.15 pm

Total Marks 20

Q1) Choose Correct Alternative

(5×1 = 5)

- 1) If $X_1, X_2, \dots, X_n$ is a random sample of size n from $N(\theta, \theta^2)$ then minimal sufficient statistic for θ is
a) $(\sum_{i=1}^n x_i, \sum_{i=1}^n x_i^2)$ b) $\sum_{i=1}^n x_i$ c) $\sum_{i=1}^n x_i^2$ d) None of these
- 2) Let 5, 8, 3, 6, 8 are observations from Poisson (λ) then unbiased estimate of λ is
a) 3 b) 6 c) 5 d) 8
- 3) The sufficient statistic for σ^2 of $N(0, \sigma^2)$ based on a single observation x is
a) x^2 b) x c) $|x|$ d) $2x$
- 4) Which of the following best defines an *ancillary statistic*?
a) A statistic whose distribution depends on the parameter.
b) A statistic that is sufficient for a parameter.
c) A statistic whose distribution does not depend on the parameter.
d) A statistic that is both sufficient and complete.
- 5) Moment estimator of θ based on random sample of size n from $P(\theta)$ is
a) Sample mean b) Sample variance
c) Both a and b d) None of these

Q2) Attempt any three

(3× 5 = 15)

1. Let $X_1, X_2, \dots, X_n$ be a sample from $LN(\mu, \sigma^2)$. Find the moment estimators of μ and σ^2 .
2. Find the maximum likelihood estimator of θ , if $X_1, X_2, \dots, X_n$ is a sample of size n from $f(x, \theta) = e^{-(x-\theta)}, x \geq \theta, \theta \geq 0$.
3. Let $X_1, X_2, \dots, X_n$ be a random sample from $N(\mu, 1)$ distribution. Show that $\frac{\sum x_i^2}{n} - 1$ is an unbiased estimator of μ^2 .
4. Let $X_1, X_2, \dots, X_n$ be a random sample from $U(a, b)$ distribution. Find sufficient statistics for parameters (a, b) .

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
M.Sc. I Statistics (Sem I) Internal Examination September-2025

Subject- Statistical Computing

Date: 24/09/2025

Time: 11.15 am to 12.15 am

Marks: 10

Q.1 Choose the correct alternative of the following **(2 Marks)**

1. What type of programming language is R?

A) Statistical

B) General-purpose

C) Scripting

D) Object-oriented

2. Which function in R can be used to generate a sequence of numbers?

A) seq()

B) gen()

C) createSequence()

D) listNumbers()

Q.2 Solve any two of the following **(8 Marks)**

1. Explain rep(), c() functions in R.

2. Explain functions in R for the following

a. To compute Spearman's rank correlation coefficient between two variables.

b. To obtain inverse of a matrix.

3. Explain the procedure of creating Data Frame in R.

Course Name: Mathematical Statistics

Course Code:

Day & Date: Thursday, 25/09/2025

Marks: 20

Time: 11.15am : 12.15pm

Q.1. Select the correct alternative for each of the following.

[05]

i) Which of the following is not a vector space?

- a) $R(R)$ b) $C(R)_n$ c) $Q(R)$ d) $R(Q)$

$$\mathbb{N} \subset \mathbb{W} \subset \mathbb{R} \subset \mathbb{Q} \subset \mathbb{C}$$

ii) The sequence $a_n = \frac{(-1)^n}{n}$ is.....

- a) Divergent b) Convergent to 0
c) Oscillatory without limit d) Convergent to 1/2

$$-\frac{1}{1} + \frac{1}{2} - \frac{1}{3} + \frac{1}{4}$$

iii) Which of the following sequences is not bounded?

- a) $a_n = (-1)^n$ b) $a_n = \frac{1}{n}$ c) $a_n = \sin x$ d) $a_n = n^2$

iv) If a sequence a_n converges to L , then which of the following is true?

- a) a_n is always bounded b) a_n must be monotonic
c) a_n is unbounded d) Limit L must be 0

v) The limit supremum of sequence $a_n = (-1)^n$ is.....

- a) 1 b) -1 c) 0 d) 2

Q.2. Attempt any three of the following.

[15]

i) Write n th term of the sequence $9, \frac{11}{4}, \frac{13}{9}, \frac{15}{16}, \frac{17}{25}, \dots$ and check its convergence.

ii) Test the convergence of the series $\frac{1}{5 \cdot 9} + \frac{1}{6 \cdot 11} + \frac{1}{7 \cdot 13} + \frac{1}{8 \cdot 15} + \dots$

iii) In any vector space $V(F)$ prove that,

- a) $0 \cdot x = 0$
b) $\alpha \cdot 0 = 0$
c) $(-\alpha)x = -(\alpha x) = \alpha(-x)$
d) $(\alpha - \beta)x = \alpha x - \beta x, \forall x \in V, \alpha, \beta \in F$

iv) Show that the vectors $(1,0,0), (1,2,3), (1,1,1)$ in $\mathbb{R}^3(\mathbb{R})$ are Linearly independent.

$$2n^2 + 15n + 28$$

Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
M.Sc. I Statistics (Sem I) Internal Examination September-2025

Subject- Research Methodology

Date: 26/09/2025

Time: 11.15 am to 12.15 am

Marks: 20

Q.1 Choose the correct alternative

(5 × 1 = 5 marks)

1. Simulation is mainly used to:

- | | |
|-----------------------------|-----------------------------------|
| A) Solve equations directly | B) Approximate real-world systems |
| C) Eliminate randomness | D) Always give exact results |

2. Which of the following is a pseudo-random number generator?

- | | |
|--|------------------------------|
| B) Coin tossing | B) Coin tossing |
| C) Linear Congruential Generator (LCG) | D) Natural radioactive decay |

3. Random numbers generated by a computer are usually:

- | | |
|---------------------------------------|------------------------|
| A) Truly random | B) Pseudo-random |
| C) Deterministic and non-reproducible | D) Without seed values |

4. In LCG, if $c=0$, the generator is called:

- | | |
|---------------------------------|--|
| A) Mixed congruential generator | B) Multiplicative congruential generator |
| C) Additive generator | D) Hybrid generator |

5. Which distribution is the basis for most random number generators?

- | | |
|-------------------------|-----------------------------|
| A) Normal distribution | B) Poisson distribution |
| C) Uniform distribution | D) Exponential distribution |

Q.2 Attempt any three of the following

(5 × 3 = 15 marks)

Q.1: What is simulation? Explain with example.

Q.2: Define pseudo-random numbers and true random numbers.

Q.3: Write the algorithm for generating n random numbers from a $B(n,p)$ distribution.

Q.4: Write the algorithm for generating n random numbers from $U[a,b]$ distribution.

Shri Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR
(Empowered Autonomous)

Department of Statistics
M.Sc. – II (Statistics) and M.Sc. – II (Applied Statistics)
Internal Examination, September 2025

Course Code – DSC17STA31 / DSC18STA31 ; Course Name – Stochastic Processes
Day & Date – Monday, 22/09/2025
Time – 11:15 am to 12:15 pm

Marks: 20

Instructions:

- i) Question 1 and Question 2 are compulsory.
- ii) From Que. 2 Attempt any 3 questions.
- iii) Figures to right indicates full marks.

Q1) Multiple Choice Questions:

[5]

1. Let $d(i)$ and $d(j)$ be the period of state i and state j respectively and if state i communicates with state j ($i \longleftrightarrow j$) then:
a) $d(i) = d(j)$
b) $d(i) > d(j)$
c) $d(i) < d(j)$
d) $d(i) \neq d(j)$
2. Which of the following statements is/are correct:
I) If a state i has period $d(i) > 1$ then it is said to be aperiodic state.
II) Any state with self – loop is Aperiodic.
a) Both are correct.
b) Both are incorrect
c) II is correct and I is incorrect.
d) I is correct and II is incorrect.
3. A Markov chain in which every state communicate with each other is.....
a) Absorbing state
b) Closed set
c) Reducible Markov chain
d) Irreducible Markov chain
4. If C is a set of states such that no state outside C can be reached from any state in C , then C is said to be
a) Open set
b) Closed set
c) Absorbing state
d) Communicating state

5) For a Markov chain X_n , which of the following statement is correct?

- a) $P(X_{n+1} | X_n, X_{n-1}) = P(X_{n+1} | X_{n-1})$
- b) $P(X_{n+1} | X_n, X_{n-1}) = P(X_{n+1} | X_n)$
- c) $P(X_{n+1} | X_n, X_{n-1}) = P(X_n | X_{n-1})$
- d) $P(X_{n+1}) = P(X_n)$

Q2. Attempt any 3 questions out of 4

[15]

1. A small shop has two coffee machines: Machine A and Machine B. Every day, the owner decides which machine to use based on the previous day's performance. If Machine A was used today and works well, there is a 70 % chance it will be used again tomorrow. If it fails, there is a 30 % chance the owner switches to Machine B. If Machine B was used today, there is a 60 % chance the owner continues with B, and a 40% chance they switch to A.

- a) Define an appropriate state space.
- b) Formulate the transition probability matrix for this Markov chain.
- c) Compute the two – day transition matrix P^2 .

2. Prove that a state 'i' is recurrent if and only if $\sum_{n=0}^{\infty} p_{ii}^{(n)} = \infty$

3. Consider a Markov chain $\{X_n; n \geq 0\}$ with state space $\{E1, E2, E3, E4\}$ and one step T.P.M as follows:

$$\begin{pmatrix} 1/2 & 1/2 & 0 & 0 \\ 1/2 & 1/4 & 1/4 & 0 \\ 0 & 0 & 1/4 & 3/4 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Suppose $P(X_0 = E2) = 1$. Let 'p' denotes the probability that the chain ever visits state E1 at least once before the chain is absorbed in E4. Determine the exact value of 3p.

4. Derive the relationship between the probability generating function of n – step transition probabilities, $P_{ii}(s) = \sum_{n=0}^{\infty} p_{ii}^{(n)} s^n$, $F_{ii}(s) = \sum_{n=1}^{\infty} f_{ii}^{(n)} s^n$

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
Department of Statistics
M.Sc. Part-II (Sem III) Internal Examination Sept 2025
Sub: Statistical Learning & Data Mining

Day: Tuesday
Date: 23 Sept 2025

Time: 11:15 am-12:15 pm
Marks: 20

Q. 1. Choose the correct alternative.

[5*1=5]

- (i) In data cleaning, which of the following methods is used to handle missing values?
A) Min-Max Normalization B) Mean/Median/Mode Imputation C) Stratified Sampling D) Bagging
- (ii) Which of the following is a metric used to evaluate classifier performance?
A) Standard Deviation B) Entropy C) Covariance D) Accuracy
- (iii) Cross-validation is primarily used to:
A) Handle missing values B) Reduce overfitting and evaluate model generalization
C) Normalize data D) Transform categorical data
- (iv) Boosting differs from bagging because:
A) Boosting uses random sampling with replacement
B) Boosting builds models sequentially and focuses on misclassified instances
C) Boosting only works for regression D) Boosting ignores weak learners
- (v) Which classification technique is based on the assumption that features are independent given the class?
A) Naïve Bayes B) Decision Tree C) K-Nearest Neighbour D) Logistic Regression

Q. 2. Solve any 3 of the following.

[3*5=15]

- (i) Describe the K-Nearest Neighbour (KNN) algorithm. Explain how the choice of 'k' is made.
- (ii) Explain the use of ROC curves and cost-benefit analysis in comparing classifiers.
- (iii) Explain the following terms: a) Sensitivity b) Specificity c) Confusion Matrix.
- (iv) Explain how statistical tests of significance can be used to compare classifiers.



Vivekanand college, Kolhapur
(An Empowered Autonomous Institute)
Department of Statistics
M.Sc. II (Statistics / Applied Statistics)
Sem III Internal Examination 2025-26
Python Programming (DSC17STA33 / DSC18STA33)

Date :24/09/2025

Time:11.15 am to 12.15 pm

Total Marks 10

Q1) Choose Correct Alternative

(2×1 = 2)

2) What is the purpose of the "break" statement in Python?_

- A) To exit a loop immediately
- B) To skip to the next iteration of a loop
- C) To repeat a statement
- D) To jump to a specific line of code

2) Which control statement is used to repeat a block of code for a specified number of iterations?_

- A) for
- B) Break
- C) if
- D) switch

Q2) Attempt any three

(4× 2 = 8)

- 4. Describe the different types of numeric data types in Python
- 5. Explain the different methods to perform input and output operations in Python.
- 6. Write a note on the slicing operation .



Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
M.Sc. II (Applied Statistics/ Statistics) (Sem III) Internal Examination Sept.-2025
Course- Statistical Quality Control
Date: 25/09/2025 Time: 11.00 am to 12.00pm Marks: 20

Q.1) Select the most correct Alternative.

(5)

- i) A production process is said to be in a state of statistical control, if it is governed by.....
- A) chance cause alone B) assignable cause alone
C) both (a) and (b) D) neither (a) nor (b).
- ii) The process standard deviation is given by.....
- A) $\bar{R}/d_2$ B) R/d_2
C) $1/d_2$ D) None of the above
- iii) If β - risk of any process is 0.75, what will be the ARL for that process?
- A) 4 A) 2
C) 1.33 C) 0.86
- iv) The 3σ limits on $\bar{X}$ control charts imply that the type I error probability is.....
- A) 0.0012 B) 0.0072
C) 0.0027 D) 0.0048
- v) The control chart designed to deal with the defects or nonconformities of a product is called
- A) C chart B) P chart
C) R chart D) S chart

Q.2 Attempt any 3 out of 4.

(15)

- i) Describe the graphical tools boxplot and normal probability plot.
- ii) Describe the tree diagram with example.
- iii) Describe construction of p chart.
- iv) Describe Phase I and Phase II in control charts.

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
M.Sc. - I (Statistics)

Internal Examination March 2026

Course Code – DSC17STA21; Course Name – Probability Theory

Day & Date – Monday, 23/03/2026

Time – 11:15 A.M to 12:15 P.M

Marks - 20

Instructions:

- a) Que.1 is compulsory.
- b) From Que. 2 attempt any 3 questions.
- c) Figures to right indicates full marks.

Q.1) Choose the correct alternative:

[5]

1) A triplet $(\Omega, \mathcal{F}, P)$ is called:

- (A) Probability function (B) Probability space (C) Random experiment (D) Event space

2) A function P defined on a sigma-algebra $\mathcal{F}$ is called a probability measure if:

- (A) $P(A) \geq 0$ (B) $P(\Omega) = 1$ (C) Countable additivity holds (D) All of the above

3) The property $P(\bigcup_{i=1}^{\infty} A_i) = \sum_{i=1}^{\infty} P(A_i)$ for disjoint events A_i is called as:

- (A) Finite additivity (B) Countable additivity (C) Sub-additivity (D) Continuity

4) If X is symmetric about zero, then the characteristic function is:

- (A) Odd function (B) Even function (C) Constant (D) Discontinuous

5) If X and Y are independent random variables, then the characteristic function of $X + Y$ is:

- (A) $\phi_X(t) + \phi_Y(t)$ (B) $\phi_X(t) \cdot \phi_Y(t)$ (C) $\phi_X(t) - \phi_Y(t)$ (D) $\phi_X(t)/\phi_Y(t)$

Q.2) Attempt any 3 out of 4

[15]

1) Let $(\Omega, \mathcal{F}, P)$ be a probability space. Define the expectation of a simple random variable and prove the linearity property, $E(X \pm Y) = E(X) \pm E(Y)$

2) State the properties of characteristic functions. Also examine whether the following function represent the characteristic function of some random variable X or not. Justify your answer.

$$\phi(t) = \frac{2}{5} e^{it} + 1$$

3) Let $\Omega = \{1, 2, 3\}$ and $\mathcal{F}$ be the collection of all subsets of Ω . If $P(\{1\}) = \frac{1}{3}$, $P(\{2\}) = \frac{1}{6}$, and $P(\{3\}) = \alpha$, determine the value of α so that P becomes a finitely additive probability measure. Also find $P(\{1, 2\})$, $P(\{1, 3\})$, and $P(\{2, 3\})$.

4) Discuss the Lebesgue measure in probability theory and mention its properties.

Que.1 Select the most correct alternative.

(5 Marks)

- 1) In the context of testing statistical hypothesis, which of the following statement is true
A) reject H_0 when H_0 is true is type II error
B) reject H_0 when H_1 is true is power of the test
C) $H_1: \mu_1 \neq \mu_2$ is one tailed alternative
D) $H_0: \mu = 4.6$ is simple null hypothesis
- 2) If critical region is entire sample space, then the level of significance of test is
A) Not defined B) one C) zero D) any number in $[0, 1]$
- 3) Let ϕ_1 and ϕ_2 are two test functions then which of the following function is not test function...
A) $\min \{ \phi_1, \phi_2 \}$ B) $\phi_1(x) \cdot \phi_2(x)$ C) $\phi_1(x) + \phi_2(x)$ D) $e^{-(\phi_1(x) + \phi_2(x))}$
- 4) A test of size α for testing simple null and alternative hypothesis which maximizes power of the test is called ...
A) Most powerful test B) Uniformly Most powerful test C) Unbiased test D) Trivial Test
- 5) A test in which power of test is greater than size of the test is called
A) Critical test B) Biased test C) Unbiased test D) Trivial Test

Que 2. Attempt any 3 out of 4.

(15 Marks)

1. A sample of size one is taken from exponential pdf with parameter θ for testing $H_0: \theta = 1$ against $H_1: \theta > 1$ having test function
$$\phi = \begin{cases} 1 & x \geq 2 \\ 0 & x \leq 2 \end{cases}$$

Find size of test and power function.
2. Obtain the MP test of size α for testing $H_0: X \sim U(0,1)$ against $H_1: X \sim U(\frac{1}{2}, \frac{3}{2})$ also find the power of the test.
3. State MLR property. Discuss MLR property for $C(\theta, 1)$ distribution.
4. Define test function. Explain randomised and non-randomised test function with suitable example.

Shri Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR (An Empowered Autonomous Institute)
DEPARTMENT OF STATISTICS
M.Sc. Part I Sem II March 2026
Multivariate Analysis (DSC17STA23)

Date: Wed, 25/03/2026

Internal Examination

Marks: 10

Instructions: i) All questions are compulsory.

ii) Figures to the right indicates full marks.

Q.1. Choose the correct alternative.

[1*2=2]

1. Relation between T^2 and D^2 is.....

a) $T^2 = \frac{n_1+n_2}{n_1 n_2} D^2$

b) $T^2 = \frac{n_1}{n_1+n_2} D^2$

c) $T^2 = \frac{n_1 n_2}{n_1+n_2} D^2$

d) $T^2 = \frac{n_1+n_2}{n_1} D^2$

2. Wishart distribution is associated with.....

a) Mean vector

b) Covariance matrix

c) Regression coefficients

d) Eigenvalues

Q.2. Attempt any two of the following.

[4*2=8]

1. Define Wishart matrix. State Wishart matrix in general case.

2. Derive the confidence region for the mean vector.

3. A random sample of size $n = 3$ is drawn from $N_2(\mu, \Sigma)$. The MLE of μ is $\hat{\mu} = \bar{X} = \begin{bmatrix} 4 \\ 5 \\ 3 \end{bmatrix}$ and the

MLE of Σ is $S = \frac{1}{3} \begin{bmatrix} 6 & 1 \\ 1 & \frac{114}{9} \end{bmatrix}$. Test the hypothesis: $H_0: \mu = \begin{bmatrix} 4.2 \\ 2 \end{bmatrix}$ vs $H_1: \mu \neq \begin{bmatrix} 4.2 \\ 2 \end{bmatrix}$

Que.1 Select the most correct alternative.

(5 Marks)

- 1) Normal probability plot is used to check:
A) Linearity B) Normality of errors
C) Independence D) Variance
- 2) If error terms are correlated, which assumption is violated?
A) Linearity B) Independence
C) Normality D) Homoscedasticity
- 3) Which assumption is NOT required in classical multiple regression?
A) Linearity B) Homoscedasticity
C) Independence of errors D) Multicollinearity
- 4) The test statistic for testing individual coefficient is:
A) F-statistic B) t-statistic
C) Z-statistic D) Chi-square
- 5) Box-Cox transformation helps in:
A) Increasing multicollinearity B) Stabilizing variance and normality
C) Reducing sample size D) Changing X values

Que 2. Attempt any 3 out of 4.

(15 Marks)

1. State the assumptions of multiple linear regression (MLR) and derive the maximum likelihood estimates (MLE) of the regression parameters.
2. Explain the procedure to test the overall significance of a multiple linear regression model.
3. Why is transformation needed in regression analysis? Explain variance stabilization transformations.
4. Define residuals in multiple regression and explain standardized residuals and studentized residuals.

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)

M.Sc. -II (Statistics)

Internal Examination March 2026

Course Code –(DSC17STA41/ DSC18STA41); Course Name – Time Series Analysis

Day & Date – Monday, 23/03/2026

Time – 11:15 A.M to 12:15 P.M

Marks - 20

Instructions:

- a) Que.1 is compulsory.
- b) From Que. 2 attempt any 3 questions.
- c) Figures to right indicates full marks.

Q.1) Choose the correct alternative:

[5]

1) Holt-Winters method is also known as:

- A) Double smoothing B) Triple exponential smoothing
C) Moving average D) AR model

2) PACF is mainly used to identify:

- A) MA model B) AR model C) Trend D) Seasonality

3) For a stationary process, ACF depends on:

- A) Time B) Lag only C) Mean D) Variance

4) For AR(1), stationarity requires:

- A) $|\phi| > 1$ B) $|\phi| < 1$ C) $\phi = 1$ D) $\phi = 0$

5) PACF of MA(q):

- A) Cuts off after lag q B) Tails off gradually C) Zero D) Constant

Q.2) Attempt any 3 out of 4

[15]

1) Discuss the single exponential smoothing method.

2) Discuss the Holt-Winters exponential smoothing method (Triple Exponential Smoothing).

3) Explain AR(1) process. Derive its Autocorrelation function and hence prove that AR(1) process is stationary.

4) Define Following terms:

- i. White Noise
- ii. Partial Auto-Correlation
- iii Auto-Correlation & its properties.

Q1) Choose Correct Alternative.

(5×1 = 5)

- 1) Scheffé's test is used for:
A) Testing variance B) Comparing all possible contrasts
C) Testing correlation D) Regression analysis
- 2) Randomization helps to:
A) Increase sample size B) Reduce bias C) Increase error D) Reduce treatments
- 3) Which of the following is a correct relation in BIBD?
A) $vr = b + k$ B) $\lambda(v - 1) = r(k - 1)$
C) $bk = v + r$ D) $\lambda k = vr$
- 4) Column sum of incidence matrix is:
A) v B) r C) k D) λ
- 5) Null hypothesis in one-way ANOVA:
A) All variances are equal B) All means are equal
C) All medians are equal D) All observations are equal

Q2) Attempt any three.

(3×5 = 15)

- 1) Explain in detail Scheffé's multiple comparison procedure.
- 2) Write a note on Fisher least significant difference method.
- 3) Explain in briefly 2^3 factorial experiment.
- 4) Discuss three relations of b , v , r , k and λ related to n_{ij} in BIBD and proof any one of them

Shri Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR (An Empowered Autonomous Institute)

M.Sc. – II (Statistics) ; Internal Examination March 2026

Course Code – DSE17STA41; Course Name – Optimization Techniques

Day & Date – Wednesday, 25/03/2026

Time – 11:15 A.M to 12:15 P.M

Marks – 20

Instructions:

- Que. 1 is compulsory.
- From Que. 2 attempt any 3 questions.
- Figures to right indicates full marks.

Q.1) Choose the correct alternative:

[5]

- A feasible solution to an LPP:
 - must satisfy all of the problem's constraints simultaneously.
 - must be a corner point of the feasible region.
 - need not satisfy all of the constraints, only some of them.
 - must optimize the value of the objective function.
- Given a system of m simultaneous linear equations in n unknowns ($m < n$), the number of basic variables will be.
 - m
 - n
 - $n - m$
 - $n + m$
- If a negative value appears in the solution values (X_B) column of the simplex method, then:
 - the basic solution is optimum
 - the basic solution is unbounded
 - the basic solution is infeasible
 - All of the above
- Dual simplex method is applicable to these LPP's that start with:
 - an infeasible solution
 - an infeasible but optimum solution
 - a feasible solution
 - a feasible and optimum solution
- Post – optimal analysis is a technique to:
 - determine how optimum solution to an LPP changes in response to problem inputs.
 - allocate resources optimally.
 - minimize cost of operations.
 - spell out the relation between dual and its primal.

Q.2) Attempt any 3 out of 4.

[15]

- Discuss the criterion used in the simplex method to test the optimality of a solution in a maximization LPP.
- Define convex function. Determine whether the following functions are convex or not. Justify your answer.
(a) $f(x) = 3x^2$ (b) $f(x) = e^x$
- Prove that the dual of the dual of a given primal is again primal.
- State the effect of a change in the objective function coefficient of a non-basic variable in LPP. Obtain the conditions under which the current optimal solution remains optimal when c_j changes to $c_j + \Delta c_j$.

VIVEKANAND COLLEGE, KOLHAPUR
(An Empowered Autonomous Institute)
DEPARTMENT OF STATISTICS
M.Sc. II (Statistics & Applied Statistics) (SEM-IV)
Python for Data Science
INTERNAL EXAMINATION MARCH 2026

Date: 25/3/2026

Marks: 20

Que.1) Choose the correct alternative.

[5]

1. Which library is used for advanced statistical modelling?
A) Stats models B) Seaborn C) Regex D) Matplotlib
2. What is the main purpose of Regular Expressions (RegEx)?
A) Data visualization
B) Pattern matching in text
C) Machine learning
D) Statistical testing
3. Which Scikit-learn module is used for clustering?
A) sklearn.linear_model
B) sklearn.cluster
C) sklearn.preprocessing
D) sklearn.metrics
4. What is the default data structure in Pandas?
A) Array B) List C) Data Frame D) Dictionary
5. Which Seaborn function is used for pairwise relationships?
A) heatmap()
B) pair plot()
C) distplot()
D) scatterplot()

Que.2) Attempt any 3 questions out of 4

[15]

1. Explain different methods of data storage (structured, semi-structured, unstructured) with examples.
2. Explain different types of layers in a sequential model:
 - a) Dense Layer
 - b) Recurrent Layer
3. Explain the difference between Classification, Regression, and Clustering with suitable examples.
4. Explain the architecture design of a Deep Neural Network (DNN) with a diagram.

